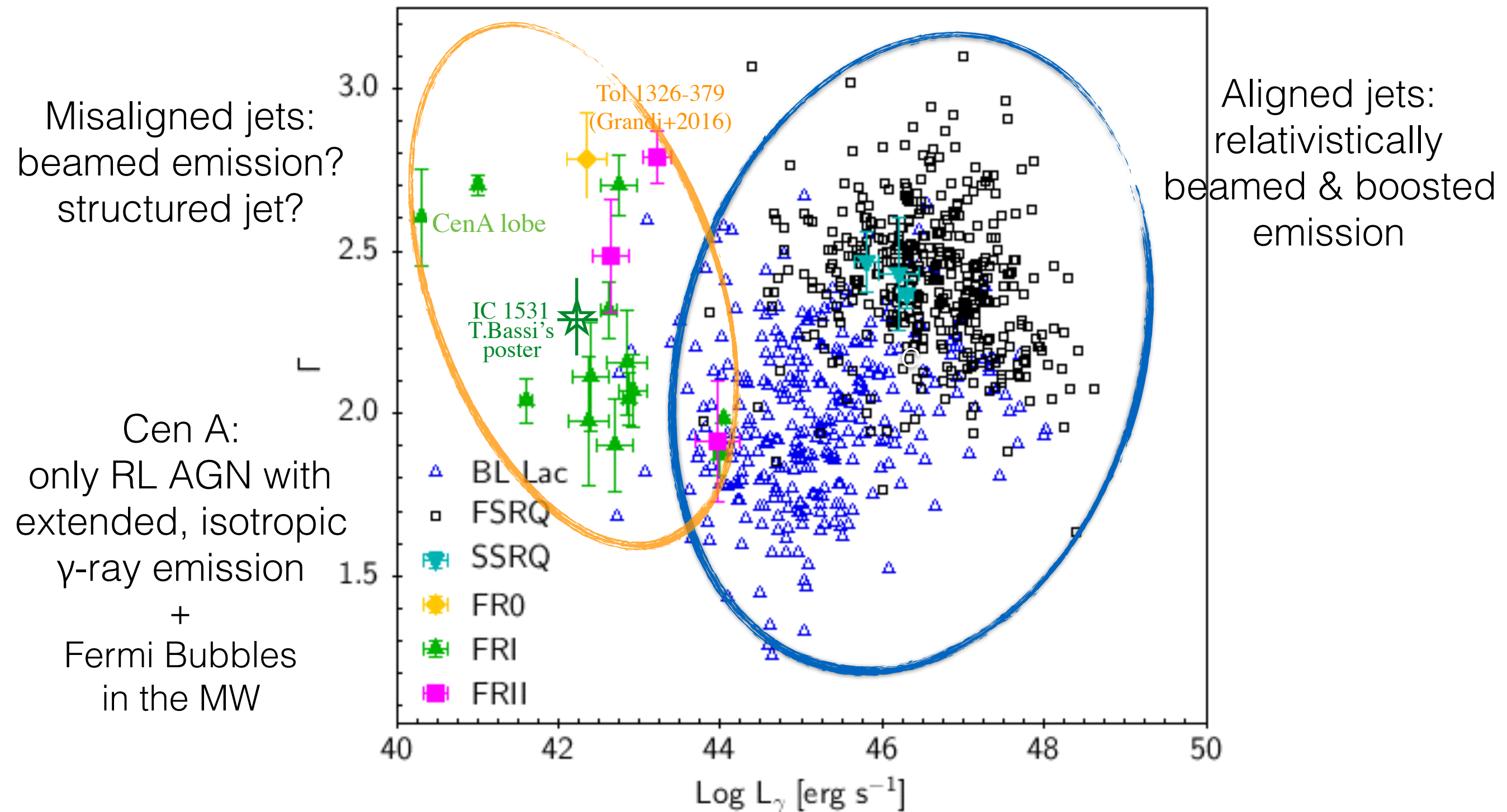


The CSO PKS 1718-649 in gamma-rays with Fermi-LAT

G.Migliori (Lab. AIM/CEA)

A. Siemiginowska (CfA), M. Sobolewska (Copernicus), A. Loh (Lab. AIM/CEA),
S. Corbel (Lab. AIM/CEA), L. Ostorero (Univ. Torino), L. Stawarz (A.O., Jagiellonian Univ.)

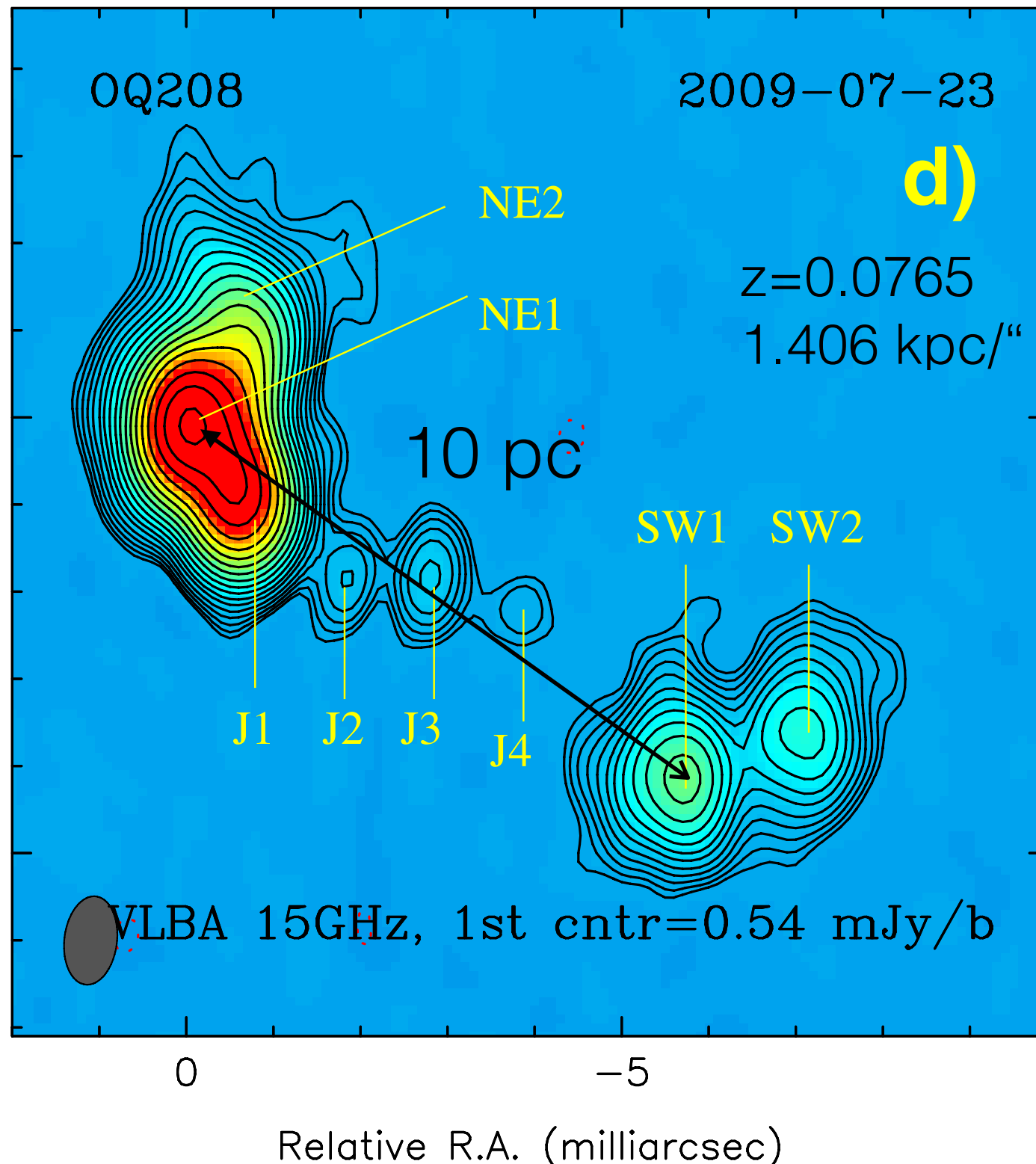
Jetted AGN in γ -rays



1/3 of the 3FGL sources are unidentified

Gamma-ray emitter candidates: Young Radio Sources

Relative R.A. (milliarcsec) Wu et al. (2013)

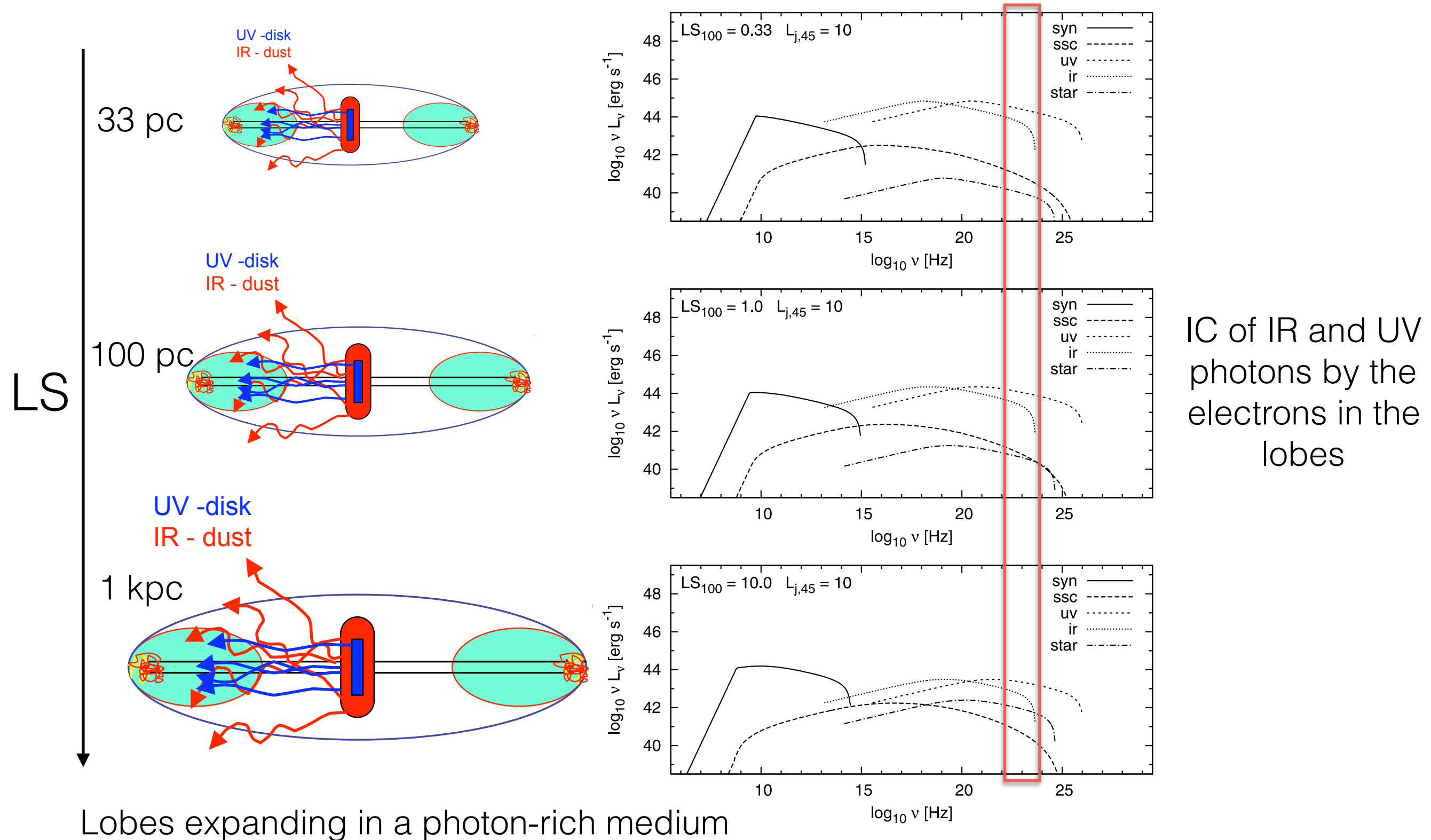


Compact Symmetric Objects (CSOs):

- linear size $< 1 \text{ kpc}$;
- symmetric, two-sided radio morphology, dominated by mini-lobes/hotspots;
- estimated ages from the hot spots advance velocities: $< 10^3 \text{ yrs}$.

CSOs in γ -rays: theory

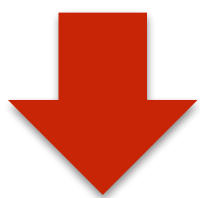
Predictions for γ -ray emission from the mini-lobes (Stawarz+2008)



γ -ray searches in 5-yr Fermi-LAT data of 16 X-ray selected CSOs (Migliori+2016a): no clear detections but a 4σ signal for one case.

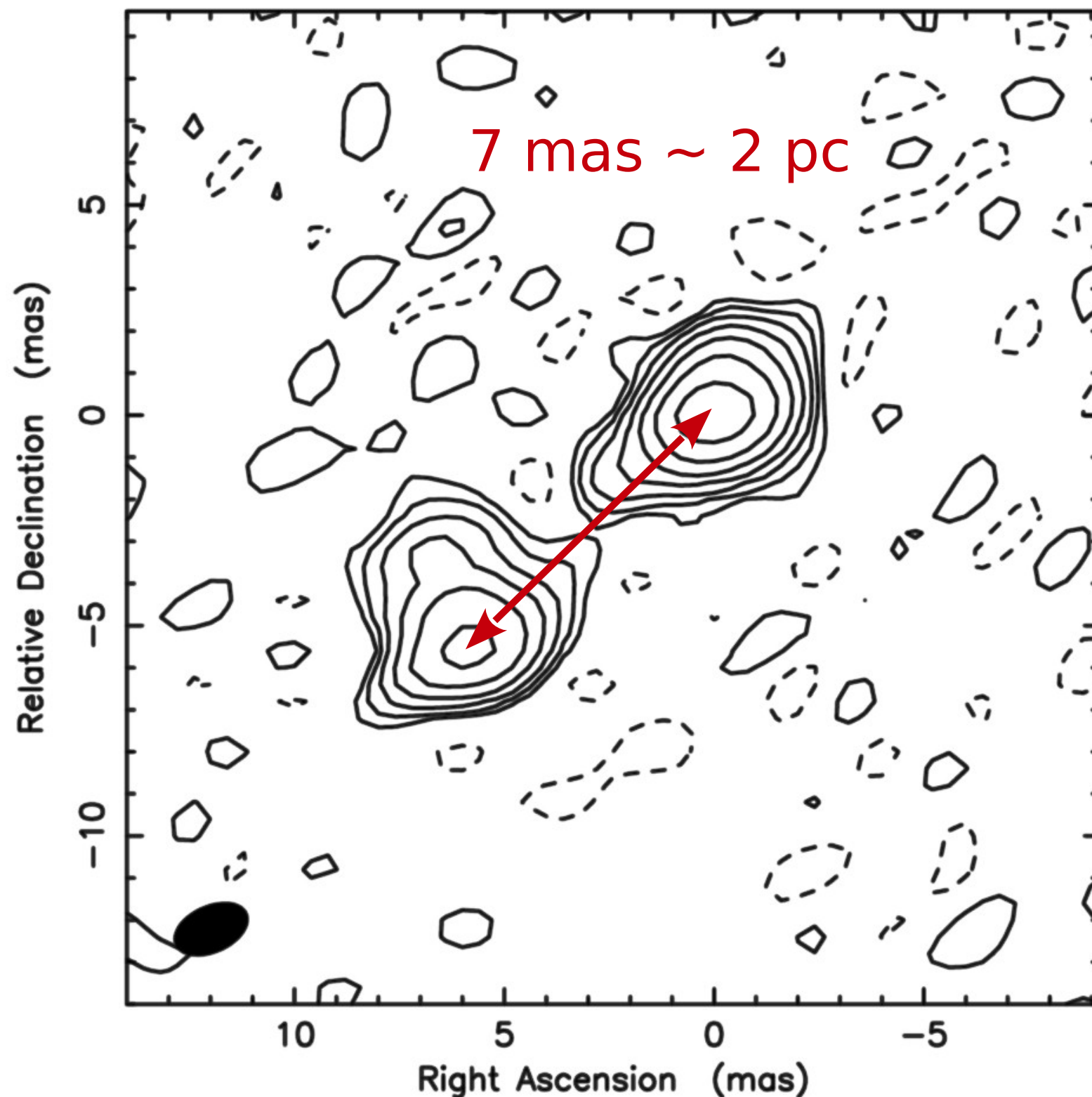
PKS 1718-649:

- closest known CSO ($z=0.014$);
- kinematically estimated age: ~ 100 yrs (Giroletti & Polatidis 2009);
- very compact radio structure



ideal candidate for a gamma-ray detection

Tingay, de Kool (2003), 22 GHz VLBI radio imaging



PKS 1718-649: 7 years of Fermi data

3-step analysis (binned likelihood, Pass 8 DR):

1. confirmation of the γ -ray detection:

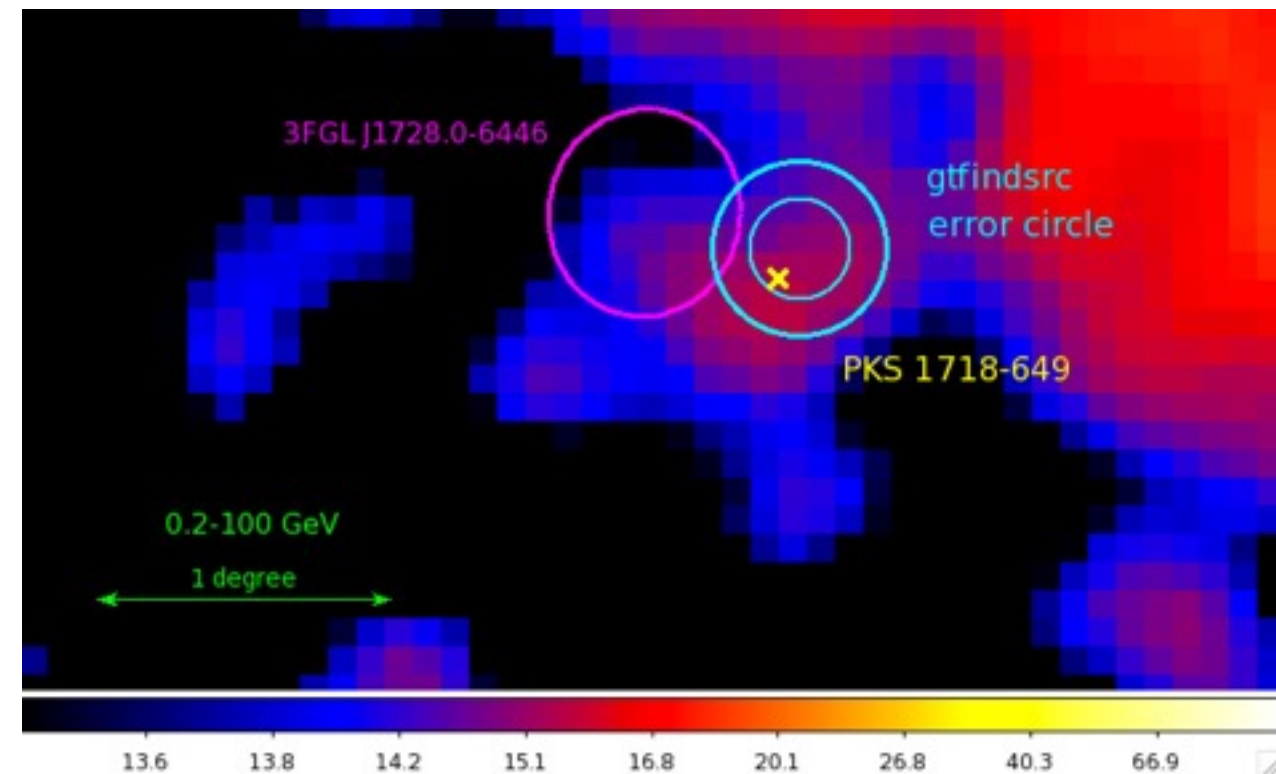
- $>5\sigma$ detection @ >100 MeV
- $\Gamma=2.9\pm0.3$;
- $F(>100\text{MeV})=(11.5\pm0.3)\times10^{-9}$ phot $^{-1}$ cm $^{-2}$ s $^{-1}$.

2. γ -ray source localization & association:

- PKS 1718-649 within the $r_{68}=0.18^\circ$ of the *gtfindsrc* best fit position;
- no other candidates in catalogs of extragalactic radio sources.

3. temporal analysis:

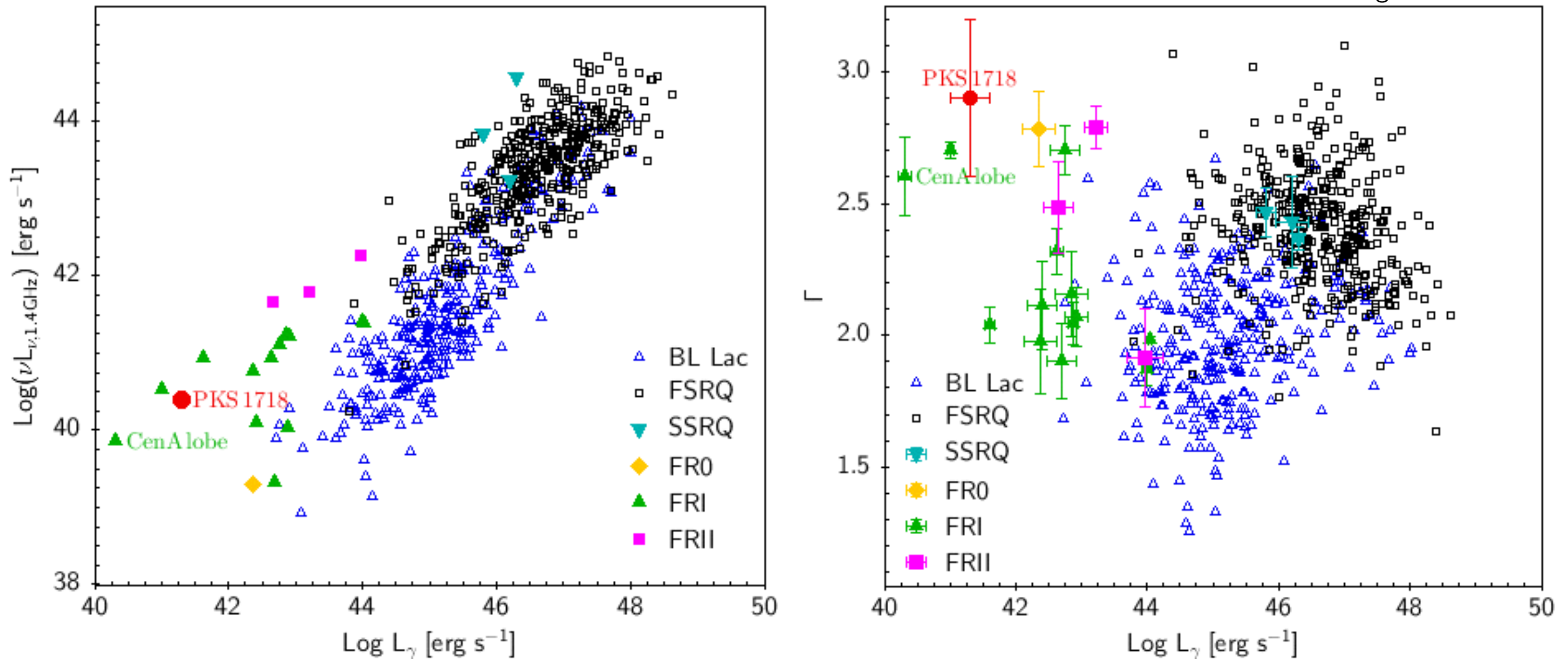
- no evidence of flux variability;
- faint and steady emission with an incrementally increasing significance.



Migliori+2016b

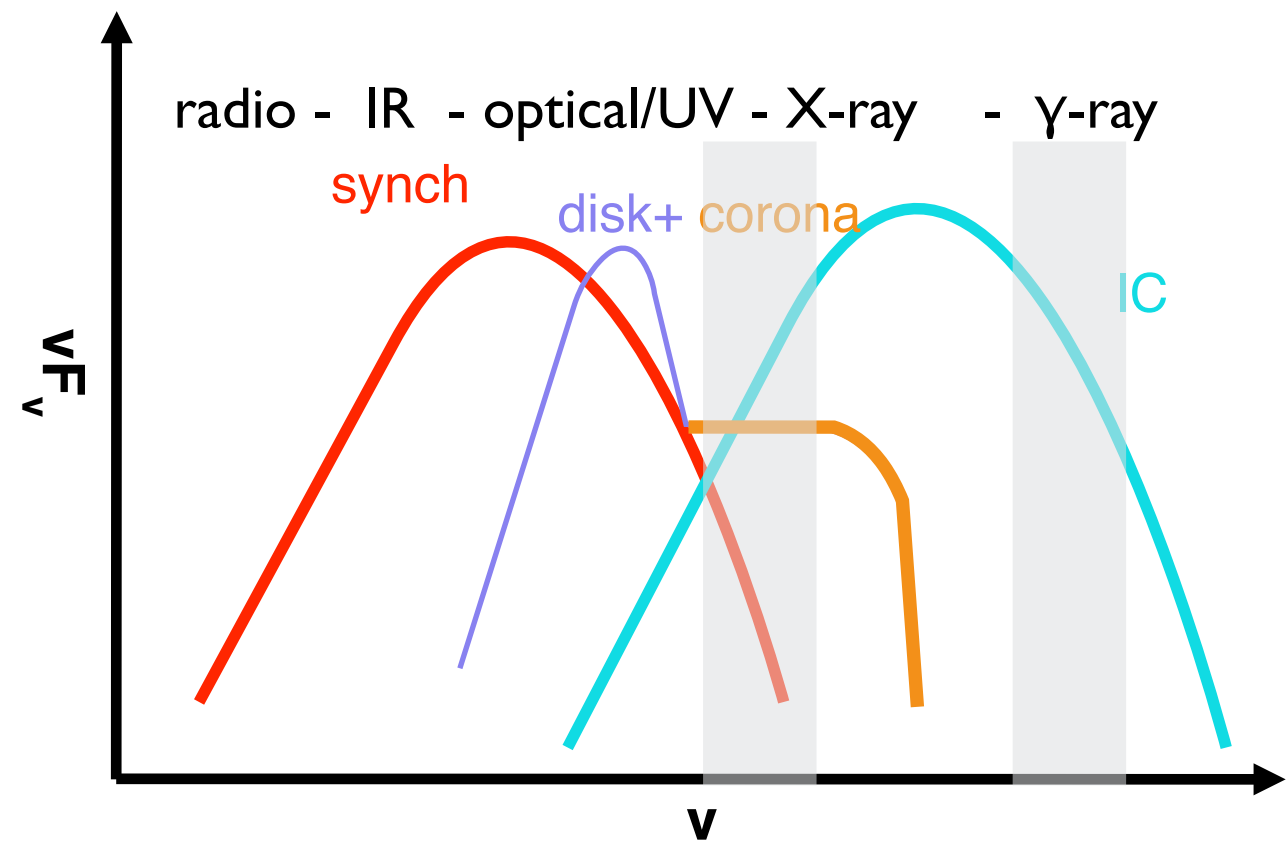
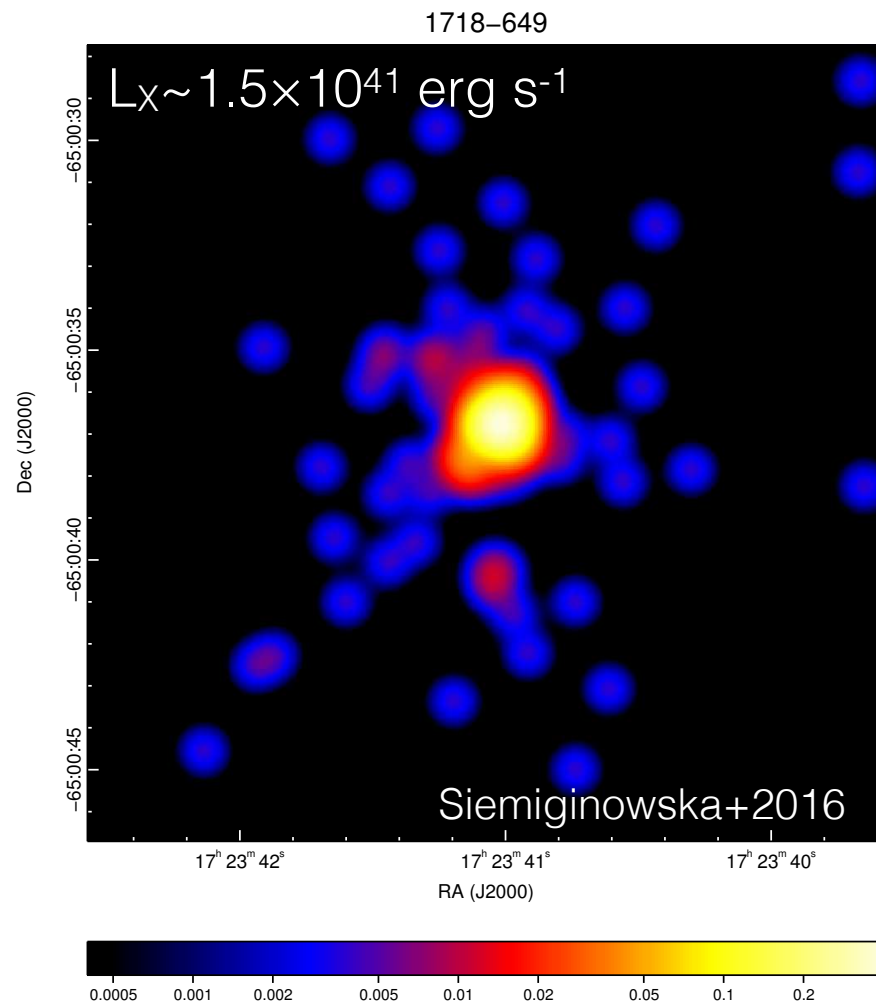
PKS 1718-648: γ -ray properties

Migliori+2016b



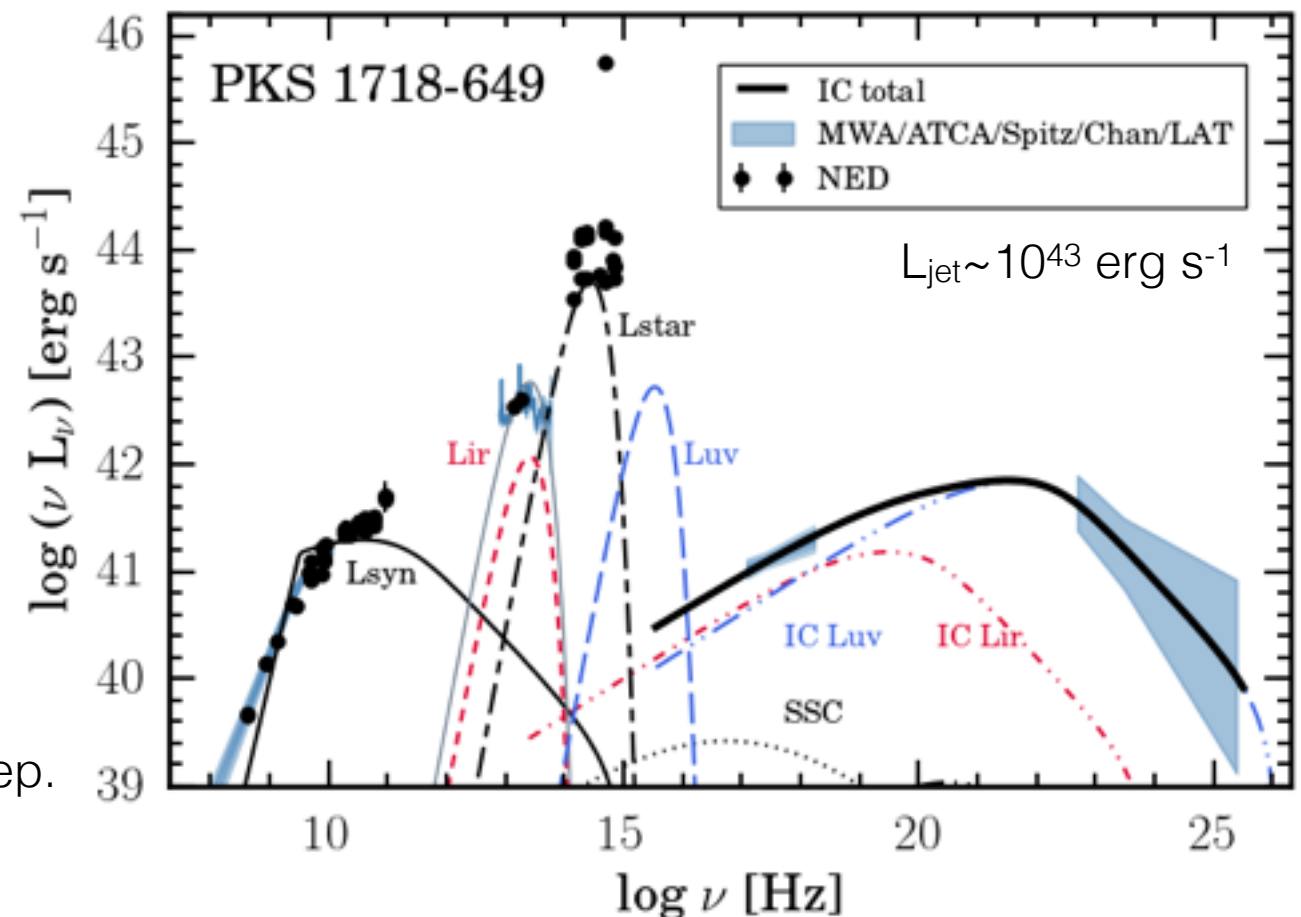
The position of PKS 1718-649 in the diagnostic plots is separated from blazars and common to MAGN + no extreme variability+ symmetric morphology:
is the gamma-ray emission produced in the compact lobes?

PKS 1718-649: nature of the high-energy emission



A detection in γ -ray provides clues on the nature of the unresolved X-ray emission.

Sobolewska+ in prep.



Fate of a Radio Source

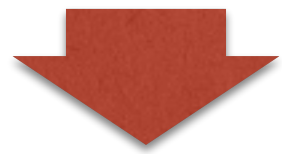
SED modeling: estimates
of the **jet power**

+

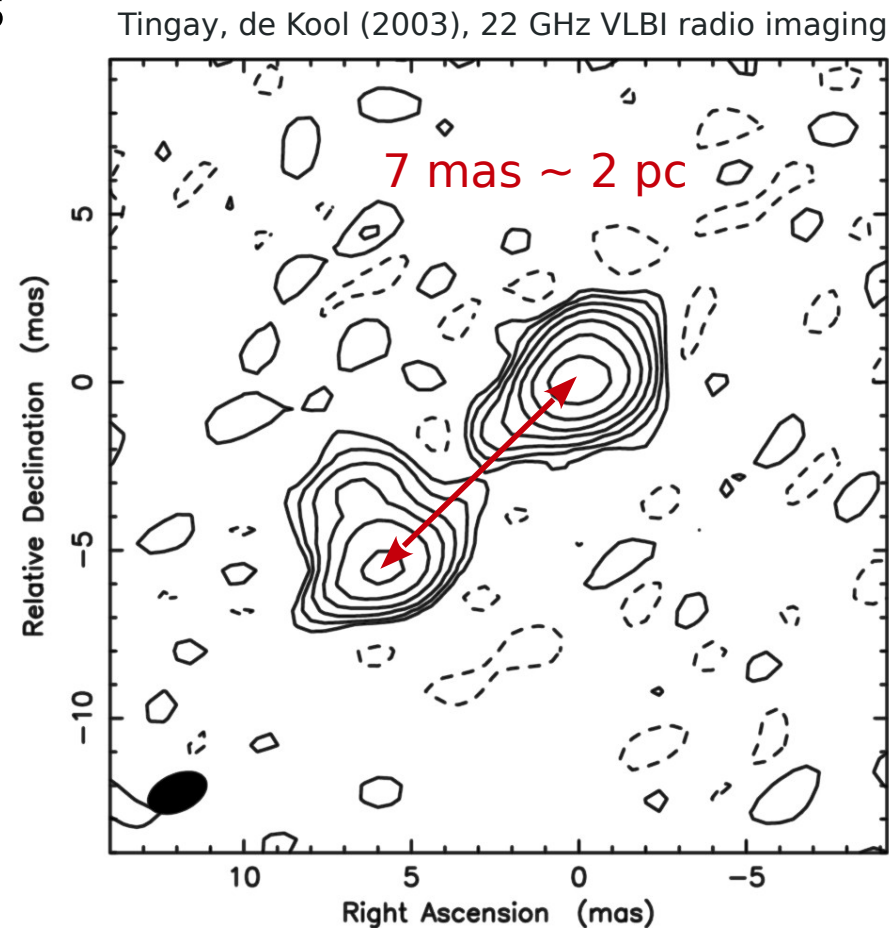
multi- λ observations

(Tingay+2003, Maccagni+2014,2016):

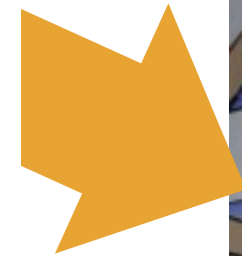
**ISM densities &
kinematics**



clues on the
radio source's evolution



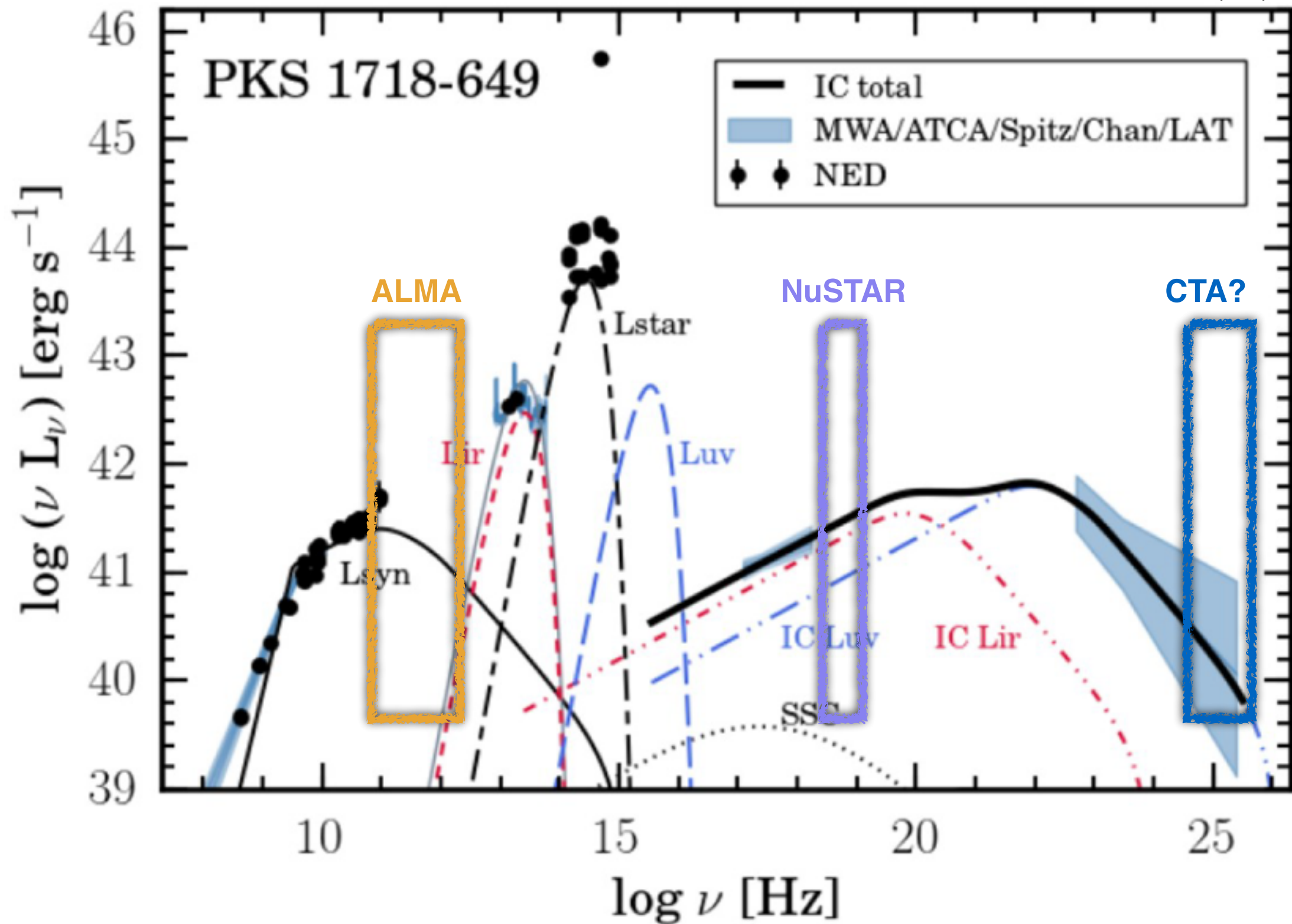
frustrated radio source



expanding radio source

SED modeling & multi- λ observations

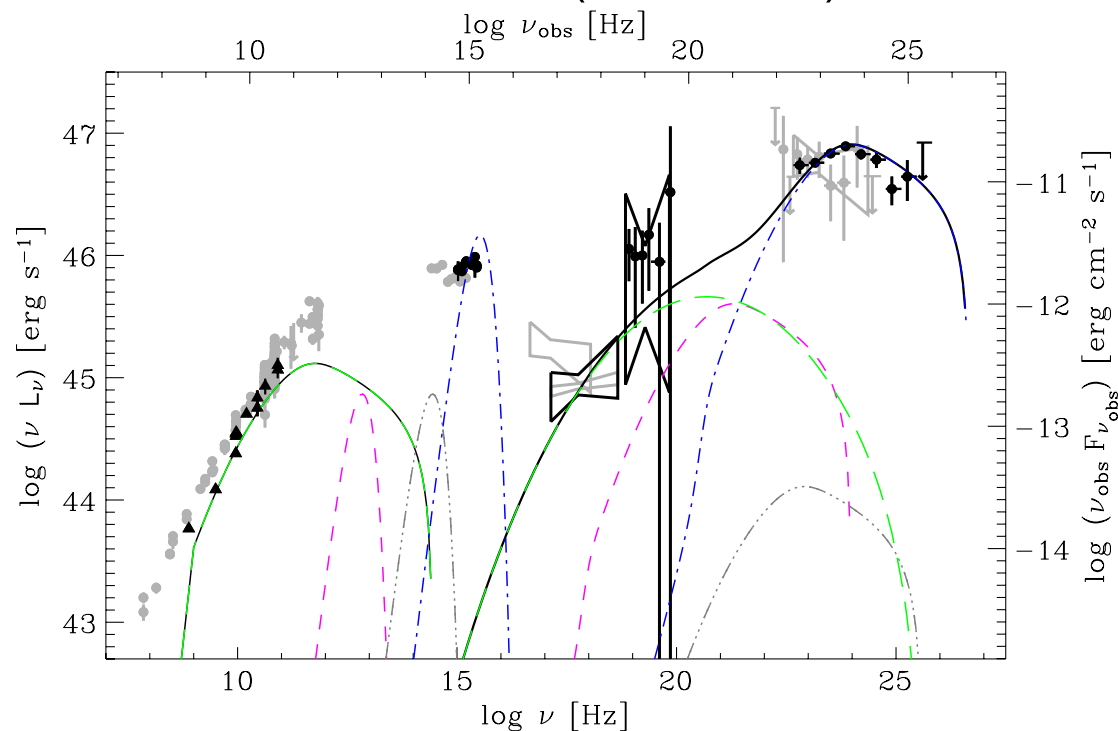
Sobolewska+ in prep.



PKS 1718-649: an isolated case?

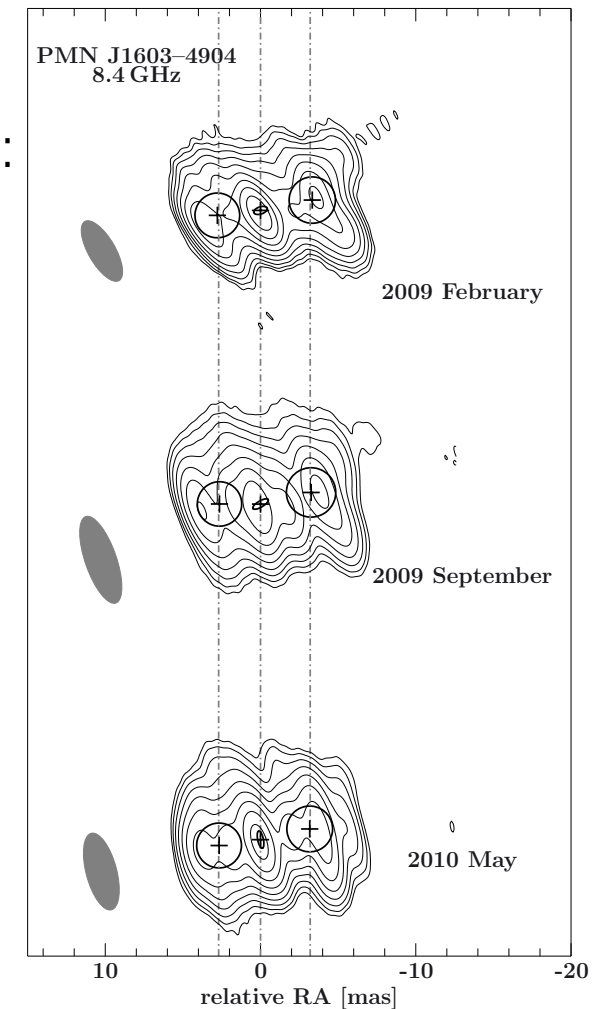
- no other clear detections of CSO classified sources in Fermi-LAT data (Migliori+2016a, D'Ammando+2016): selection criteria?
- Fermi-LAT sources with a CSO-like small scale structure:

4C +55.17 ($z=0.896$):



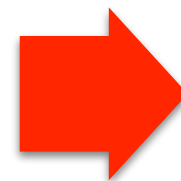
McConville+2011

PMN J1603-4904 ($z=0.18$):



Müller+2014,2015

- γ -ray bright and hard spectrum;
- no short term, extreme variability;
- mas symmetric radio structure;
- located at larger z .



Is the γ -ray emission produced in the mini-lobes?

Conclusions & Future Work

- The analysis of 7 yrs of LAT data (Pass 8 DR) confirms the detection ($>5\sigma$) of a γ -ray source associated with the CSO PKS 1718-649;
- the absence of extreme flux variability and the source location in the diagnostic plots are compatible with the gamma-ray emission being produced in the lobes;
- modeling of the SED of PKS 1718-649 (Sobolewska+in prep.) will give clues on the nature of the X-ray emission and its evolution (new Chandra observations, PI: Siemiginowska);
- CSO searches in γ -rays: how can we find other CSOs among unidentified LAT sources? selection criterium?